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Wisconsin Department of Commerce

Evaluation # 200513-W (Replaces 200410-W)

Safety & Buildings Division
201 West Washington Avenue
P.O. Box 2658
Madison, WI 53701-2658

Wisconsin Building Products Evaluation

Material	LP LVL (Also known as Gang-Lam™ Laminated Veneer Lumber) TecLam LVL and Solid Start® Oriented Strand Lumber (OSL)
Manufacturers	Louisiana-Pacific Corporation 2706 HWY 421 North Wilmington, NC 28401 Louisiana-Pacific Corporation Highway 20 West Hines, OR 97738 Louisiana-Pacific Corporation 1221 10th Avenue North P.O. Box 170 Golden, BC Canada V0A 1H0 Louisiana-Pacific Corporation 16571 W. US Highway 63 South Hayward, WI 54843
Licensee	Wesbeam Pty. Ltd 190 Pederick Road Neerabup, WA 6019 Australia

SCOPE OF EVALUATION

GENERAL: This report evaluates the use of LP LVL, TecLam LVL and Solid Start OSL, manufactured by Louisiana-Pacific Corporation, for use as structural framing lumber (engineered).

This review includes the cited **Comm** code requirements below in accordance with the current **Wisconsin Uniform Dwelling Code for 1 & 2 family dwellings:**

- **Structural:** The LVL and OSL were evaluated for use in dry locations, and not limited to beams, headers, joists, rafters, columns, studs, rim board, components in built-up structural members such as flanges for I-joists, chords for trusses and laminations for glued-laminated members in accordance with **s. Comm 21.02(3)(a)2.** and **s. Comm 21.19**.

The **IBC** requirements below in accordance with the current **Wisconsin Amended ICC Code:**

- **Structural:** The LVL and OSL were evaluated for use in dry locations, and not limited to beams, headers, joists, rafters, columns, studs, rim board, components in built-up structural members such as flanges for I-joists, chords for trusses and laminations for glued-laminated members in accordance with **s. IBC. 2301.2, 2301.2.1, 2303.1, 2306.1**.

DESCRIPTION AND USE

LP LVL and TecLam LVL are made up of layers of wood veneers laminated together using an exterior-type structural adhesive. The manufacturing process consists of rotary peeling a log into veneers that are then dried and graded. After the veneers are coated with adhesive they are laid-up into a billet that is then fed into a hot press that cures the adhesive under heat and pressure. The cured and compressed billet then leaves the hot press and is ripped into boards, which completes the LVL manufacturing process. LP LVL is also available in larger sections fabricated through secondary glue lamination.

Solid Start OSL is made up of wood wafers bonded together using an exterior-type structural adhesive. The manufacturing process consists of flaking a log into wafers that are then dried. After the dried wafers are coated with adhesive they are formed into a mat that is then fed into a hot press that cures the adhesive under heat and pressure. The cured and compressed mat then leaves the hot press and is ripped into boards, which completes the OSL manufacturing process.

The wood veneer/wafer properties and species, adhesive, manufacturing parameters, and finish product thickness, width and length shall meet the requirements noted in the approved quality control manual that contains the manufacturing standard.

The grades of LVL and OSL are given in Table 1.

Design:

General: The design provisions for solid-sawn lumber in the ANSI/AF&PA NDS *National Design Specification for Wood Construction* (NDS®), except as modified herein, are applicable to the LVL and OSL described in this evaluation report. The allowable design values for the evaluated products in this report under dry-use conditions are given in Table 1, Table 2, and Table 3. The allowable design values may be adjusted for duration of load in accordance with the applicable code.

Connections: The design of connections for the LVL and OSL described in this evaluation report shall be in accordance with the NDS for a solid wood species with an equivalent specific gravity. The equivalent specific gravity characteristics for nail and bolt design for dry-use conditions are found in Table 2. The nail spacing requirements are found in Tables 4 and 5. Specific approval by the building official is required for connections other than those indicated in Tables 2, 4, and 5.

Rim Board: For the purpose of this evaluation report, rim boards are defined as continuously supported structural members (except as noted in Item 7 below), located at the joist elevation either perpendicular to, or parallel to, the joist framing, that are the full depth of the joist space and are used for the following purposes:

1. Transfer, from above to below, of vertical loads at the rim board location. Allowable vertical loads are noted in Table 3.
2. Provide diaphragm attachment (sheathing to top edge of rim board).
3. Transfer in-plane lateral loads from the diaphragm to the wall plate below.
4. Provide lateral support to the joist or rafter (resistance against rotation) through attachment to the joist or rafter.
5. Provide closure for ends of joists or rafters.
6. Provide attachment base for siding or exterior deck ledger.
7. Design of rim to span over wall openings shall not exceed the allowable design stresses are noted in Table 1.

TESTS AND RESULTS

APA-The Engineered Wood Association approval letters on Louisiana-Pacific Corporation Test Reports verify that a representative from APA-The Engineered Wood Association has witnessed the following qualification tests:

LP LVL

- Tension tests in accordance with ASTM D198 were performed.
- Compression tests perpendicular to the grain were performed in accordance with ASTM D143.
- Compression tests parallel to the grain were performed in accordance with ASTM D198.
- Horizontal shear testing in accordance with ASTM D143, Lateral Nail Capacity and Lateral Nail Withdrawal testing in accordance with ASTM D1761, were also performed.
- Mechanical property tests were performed in accordance with ASTM D5456. Allowable design values were assigned in accordance with ASTM D5456 and other appropriate standards.
- All mechanical property testing was conducted and/or witnessed by independent test laboratories or third party inspection agencies (APA-The Engineered Wood Association). Test data and results are on file with the department.

TecLam LVL

- Physical property tests were conducted at Washington State University in accordance with ASTM D5456. Test data and results are on file with the department.

Solid Start® OSL

- Tension tests in accordance with ASTM D4761 were performed.
- Bending tests in accordance with ASTM D4761 were performed.
- Compression tests parallel to grain measured in accordance with ASTM D198 was performed.
- Compression tests perpendicular to the grain were performed in accordance with ASTM D143.
- Horizontal shear tests in accordance with ASTM D143.
- Fastener withdrawal-nail withdrawal resistance tests in accordance with ASTM D1761.
- Fastener dowel bearing strength tests for both nails and bolts in accordance with ASTM D5764.
- Moisture content and specific gravity were measured in accordance with ASTM D4442 and D2395.

LVL and OSL Test data and results are on file with the department and were prepared in accordance with ASTM D5456 and ICC ES Acceptance Criteria AC47 (Structural Composite Lumber), AC124 (Wood-Based Rim Board Products) and AC202 (Wood-Based Studs).

Louisiana-Pacific Corporation's Quality Assurance Manuals for LP LVL, TecLam LVL and Solid Start® OSL are on file with the department.

Table 1 - Allowable Stress Design Values[7, 8]

Grade	Bending Strength, F_b (psi)		Tensile Strength Parallel to Grain, F_t (psi)	Compression Strength Parallel to Grain, $F_{c\parallel}$ (psi)	Compressive Strength Perpendicular to Grain, $F_{c\perp}$ (psi)		Horizontal Shear Strength, F_v (psi)		Modulus of Elasticity ($x10^6$ psi)	
	Beam	Plank			Beam	Plank	Beam	Plank	Beam	Plank
Solid Start OSL										
$1750F_b$-1.3E	1750[1]	2650	1450[5]	1940	1675	520	430	135	1.30	1.55
LP LVL										
$1650F_b$-1.3E	1650[2]	1650	1200[6]	1700	750	550	285	140	1.30	1.30
$1750F_b$-1.3E	1750[4]	1750	1200[6]	1700	750	550	285	140	1.30	1.30
$2250F_b$-1.5E	2250[2]	2200	1350[6]	2350	750	550	285	140	1.50	1.40
$2650F_b$-1.8E	2650[2]	2600	1600[6]	2350	550	450	285	140	1.80	1.80
$2750F_b$-1.8E	2750[2]	2600	1600[6]	2350	750	550	285	140	1.80	1.80
$2650F_b$-1.9E	2650[2]	2600	1600[6]	2350	750	550	285	140	1.90	1.80
$2850F_b$-2.0E	2850[2]	2850	1800[6]	3200	1020	550	290	140	2.00	2.00
$2950F_b$-2.0E	2950[2]	2950	1800[6]	3200	1020	550	290	140	2.00	2.00
$3100F_b$-2.0E	3100[2]	3100	1800[6]	3200	1020	550	290	140	2.00	2.00
$3400F_b$-2.0E	3400[2]	3400	1800[6]	3350	995	550	350	120	2.10	2.10
TecLam LVL										
$2250F_b$-1.8E	2250[2]	NA	1600[6]	2300	750	550	285	190	1.80	NA
$2600F_b$-1.8E	2600[2]	NA	1600[6]	2300	750	550	285	190	1.80	NA
$2850F_b$-2.0E	2850[2]	NA	1750[6]	2800	750	550	285	190	2.00	NA
$3200F_b$-2.2E	3200[2]	NA	2050[6]	2950	750	550	285	190	2.20	NA

For SI: 1 psi = 6.89 kPa, 1 inch = 25.4 mm.
NA = Not Applicable
Notes:

1. The allowable bending strength, F_b, is assigned for a standard depth of 12-inches. For other depths, multiply F_b by $(12/depth)^{1/7.2}$. For depths less than 2 ½-inches, multiply F_b by 1.243. Note: "depth" is the depth of the member in inches.
2. The allowable bending strength, F_b, is assigned for a standard depth of 12-inches. For depths greater than 12-inches, multiply F_b by $(12/depth)^{1/7}$. For depths less than 12-inches, multiply F_b by $(12/depth)^{1/9}$. For depths less than 3 ½-inches, multiply F_b by 1.147. Note: "depth" is the depth of the member in inches.
3. The allowable bending strength, F_b, is assigned for a standard depth of 12-inches. For other depths, multiply F_b by $(12/depth)^{1/3.10}$. For depths less than 3 ½-inches, multiply F_b by 1.488. Notes: (1) "depth" is the depth of the member in inches. (2) Available thickness (t): 1"< t < 1 ¼".
4. The allowable bending strength, F_b, is assigned for a standard depth of 12-inches. For other depths, multiply F_b by $(12/depth)^{1/3.83}$. For depths less than 3 ½-inches, multiply F_b by 1.379. Notes: (1) "depth" is the depth of the member in inches. (2) Available thickness (t): 1 1/4"< t < 1 1/2".
5. The allowable tension strength, F_t, is assigned for a standard length of 4-feet. For lengths other than 4-feet, multiply F_t by $(4/length)^{1/14.2}$. For lengths less than 2-feet, multiply F_t by 1.050. Note: "length" is the length of the member in feet.
6. The allowable tension strength, F_t, is assigned for a standard length of 3-feet. For lengths other than 3-feet, multiply F_t by $(3/length)^{1/9}$. For lengths less than 3-feet, use the design tension stresses in the table above, unadjusted.
7. Allowable design stresses in the above table are for normal load duration and shall be adjusted (with the exception of modulus of elasticity and compressive strength perpendicular to grain) using the load duration factors found in the *NDS*.
8. Allowable design stresses in the above table shall apply to product installation conditions of use that are dry, well ventilated and covered. Dry conditions are product installation conditions where ambient moisture content is 16% or less.

Table 2 - Equivalent Specific Gravity for Fastener Design[1, 2]

Product	Equivalent Specific Gravity							
	Nails				Bolts Installed in Face[3]			
	Withdrawal Load		Lateral Load		Lateral Load (1/2" Dia.)		Lateral Load (3/4" Dia.)	
	Installed in Edge	Installed in Face	Installed in Edge	Installed in Face	Load Applied // to Grain	Load Applied ⊥ to Grain	Load Applied // to Grain	Load Applied ⊥ to Grain
Solid Start OSL[4]	0.42	0.46	0.51	0.62	0.54	0.54	0.54	0.54
LP A LVL	0.43	0.43	0.42	0.43	0.42	0.43	0.39	0.43
LP P LVL	0.46	0.46	0.50	0.50	0.42	0.55	0.42	0.55
LP L LVL LP W LVL[5, 6] LP LW LVL LP S LVL LP PS LVL TecLam LVL	0.46	0.50	0.50	0.50	0.46	0.50	0.46	0.50

For SI: 1 psi = 6.89 kPa

NOTES:
1. Fastener sizes and orientation not specifically described above are beyond the scope of this report.
2. Fastener values based on the equivalent specific gravities in the above table are for normal load duration and shall be adjusted using the load duration factors found in the *NDS*.
3. The bolt edge distance for 1/2" and 3/4" diameter bolts when loaded parallel and perpendicular to the grain shall be a minimum of four times the bolt diameter.
4. For the 1750 F_b-1.3E Solid Start OSL grade, the lateral capacity of ½" lag screws installed into the face is 500 lbs. for 11/4" thickness and greater, based on a 1 ½" thick side member with full penetration of the lag screw.
5. For the 1650 F_b-1.3E LP LVL grade, the lateral capacity of ½" lag screws installed into the face varies with thickness as follows (based on a 1 ½" thick side member with full penetration of the lag screw): 350 lbs. for 1", 400 lbs. for 1-1/8". The 1650 F_b-1.3E LP LVL grade is made of Douglas Fir-Larch species veneers.
6. For the 1750 F_b-1.3E LP LVL grade, the lateral capacity of ½" lag screws installed into the face is 400 lbs. for 1-1/4" thickness and greater, based on a 1 ½" thick side member with full penetration of the lag screw. The 1750 F_b-1.3E LP LVL grade is made of Douglas Fir-Larch species veneers.

Table 3 - Allowable Stress Design Values for Rim Board [1, 2, 3]

Thickness (inches)	Product	Lateral Load Capacity[4] (lb./ft.)	Vertical Uniform Load Capacity[5] (lb./ft.)		Vertical Concentrated Load Capacity (lbs.)
			Depth ≤ 16 Inches	Depth > 16 Inches	Depth > 16 Inches
1-1/4 and 1-1/2	Solid Start OSL	215	9750	4650	5160
1	LP LVL	190	7210	4990	3870
1-1/8	LP LVL	220	8280	5030	4040
1-¼	LP LVL	300	9350	5070	4210

For SI: 1 inch = 25.4 mm, 1 lb. = 4.45 N, 1 lb./ft = 14.6 N/m

NOTES:
1. Toe-nailed connections are limited by the 150 plf lateral load capacity noted for seismic Zones 3 and 4 in Section 2318.3.1 of the UBC, or Seismic Design Categories D, E and F in Section 2305.1.4 of the IBC.
2. Allowable design loads in the above table cannot be increased for load duration.
3. See Table 4 and Table 5 for minimum nail spacing requirements.
4. The nailing schedule for sheathing to rim and rim board to sill plate (toe-nailed) is based on 8d box nails at 6 inches on center (refer to AC124 for full details). Commercial framing connectors may be used to achieve lateral load capacities exceeding the values in this table. Calculations shall be based on the equivalent specific gravity listed in Table 2 and shall not exceed the nail spacing requirements of Table 4 (LVL) or Table 5 (OSL).
5. The allowable Vertical Uniform Load Capacity is based on the strength of the rim board and may need to be reduced based on the bearing capacity of the supporting wall plate. Bearing capacity for an SPF plate is limited to 5100 lb./ft for 1 inch-thick rim board (425 psi x 12 in. x 1 in.), 5700 lb./ft for 1-1/8 inch-thick rim board (425 psi x 12 in. x 1-1/8 in.) and 6350 lb./ft for 1-1/4 inch-thick rim board (425 psi x 12 in. x 1-1/4 in.). The 425 psi compression perpendicular to grain design value for SPF is found in Table 4A of the *NDS Supplement*.

Table 4 - Nail Spacing Requirements for LP LVL

Thickness (inches)	Orientation	Fastener	Closest End Distance (inches)	Closest On Center Spacing (inches)
< 1 ½	Edge	8d & smaller	2 ½	4
		10d & 12d	2 ½	4
		16d	3 ½	5
	Face	8d & smaller	1 ½	3
		10d & 12d	1 ½	3
		16d	1 ½	5
≥1 ½	Edge	8d & smaller	2 ½	3
		10d & 12d	2 ½	4
		16d	3 ½	5
	Face	8d & smaller	1 ½	3
		10d & 12d	1 ½	3
		16d	1 ½	5

For SI: 1 inch = 25.4 mm

Table 5 - Nail Spacing Requirements for Solid Start OSL

Thickness (inches)	Orientation	Fastener	Closest End Distance (inches)	Closest On Center Spacing (inches)
< 1 ½	Edge	8d & smaller	2	3
		10d & 12d	2	3 ½
		16d	2 ½	3 ½
	Face	8d & smaller	7/8	1
		10d & 12d	7/8	1
		16d	7/8	1 ½
>=1 ½	Edge	8d & smaller	2	3
		10d & 12d	2	3
		16d	2 ½	3
	Face	8d & smaller	7/8	1
		10d & 12d	7/8	1
		16d	7/8	1 ½

For SI: 1 inch = 25.4 mm

NOTES for Tables 4 and 5:

1. Tabulated closest on center spacing for face orientation are applicable to nails that are installed in rows that are parallel to the direction of the grain (length) of the LVL or OSL. For nails that are installed in rows that are perpendicular to the direction of the grain (width/depth) of the LVL or OSL, the closest on center spacing for face orientation shall be sufficient to prevent splitting in the wood.
2. Fastener sizes and closest spacing not specifically described above are beyond the scope of this report.
3. Fasteners are common wire or box nails.
4. Edge distance shall be sufficient to prevent splitting.
5. Nail penetration for edge nailing shall not exceed 2 inches for 16d nails and 2 ½ inches for 10d and 12d nails.
6. 16d sinkers (3 ¼" x 0.148") may be spaced the same as a 12d common wire nail.
7. For multiple rows of nails, the rows must be offset ½ inch or more from each other and staggered.
8. For multiple rows of nails, rows must be equally spaced from the centerline of the product edge or face (whichever applies).

LIMITATIONS OF APPROVAL

This evaluation number permits the use of the allowable design stresses as specified. It does not take the place of structural calculations for assemblies using LP LVL, LP LVL Rim Board, TecLam LVL or Solid Start® OSL when required by **Chapters Comm 20-25** or **IBC Chapter 23**. Applications not covered by this evaluation and requiring special considerations may be handled by contacting Louisiana-Pacific Corporation for guidance and submitted for review when required by **Chapters Comm 20-25** or **IBC Chapter 23**.

All design values, with the exception of F_c perpendicular-to-grain and modulus of elasticity, may be adjusted for duration of load per the NDS. The allowable bending stress, F_b, of members that qualify as repetitive members, as defined in NDS, may be increased by 4%.

LIMITATIONS OF APPROVAL

The **IBC** limitations below are in accordance with the current **Wisconsin Amended ICC Code:**

Installation: LP LVL, TecLam LVL, and Solid Start OSL shall be installed in accordance with this evaluation report and applicable building codes, the specifications of the design professional responsible for the design of the structure and, in lieu of a project designer, the latest edition of Louisiana-Pacific Corporation's installation guidelines. LP's installation guidelines are general recommendations only and shall be superceded by any and all details specified by the design professional responsible for the design of the structure. Structural calculations, drawings, specifications, and/or LP's installation guidelines shall be made available to the code official in accordance with **s**. **Comm 20.09(4)** and **s. Comm 61.30** of the current **UDC** and **Wisconsin Amended ICC Code** respectively.

Identification: LP LVL, TecLam LVL, and Solid Start OSL shall be identified with markings noting the manufacturer's name and/or trademark, plant number, product designation, grade, evaluation report number 200513-W and third-party inspection agency name and/or trademark as required by **ss. Comm 20.18** or **61.60** of the current **UDC** and **Wisconsin Amended ICC Code** respectively.

This approval will be valid through December 31, 2010, unless manufacturing modifications are made to the product or a re-examination is deemed necessary by the department. The product approval is applicable to projects approved under the current edition of the applicable codes. This approval may be void for project approvals made under future applicable editions. The Wisconsin Building Product Evaluation number must be provided when plans that include this product are submitted for review.

DISCLAIMER

The department is in no way endorsing or advertising this product. This approval addresses only the specified applications for the product and does not waive any code requirement not specified in this document.

Revision Date:
Approval Date: August 30, 2005 By: _____

Lee E. Finley, Jr.
Product & Material Review
Integrated Services Bureau

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